

TECHNICAL SPECIFICATION OF CTC

A. SINGLE STRAND

1. Width (mm) 3.5 to 12.5
2. Thickness (mm) 1.2 to 3.0
3. Ratio Width to Thickness 2.5 to 6
4. Min. Cross section 4.2 Sq. mm
5. Max. Cross section 36 Sq. mm
6. Tolerance on bare As per IEC 60317-0-2
7. Radius on Corner As per IEC 60317-0-2

B. COPPER

1. Oxygen free high conductivity copper CW 008A As per DIN EN 13601
2. ETP Grade Copper CW 004A As per DIN EN 13601
3. Copper- Silver alloy CW 019A As per DIN EN 13601

C. CTC

1. No. of strip 5 to 64 Both even and odd in number
2. Width of Stack (Axial) 26 mm. Max.
3. Height of Stack (Radial) 80 mm Max.
4. Pitch 40 to 200 mm
5. Cross over length 20 mm min. or 4 times the width of single strip
6. Transposing factor
 $\geq 6 \leq 9$ for Height to Width ratio ≥ 3.2
 $\geq 10 \leq 12$ for Height to Width ratio 2 to 3.2
No restriction when Height to Width ratio ≤ 2

Maximum transposing factor is 15

7. Interleaving paper For stack height ≥ 10

D. WORK HARDENED COPPER

CPR VALUES	0.1% CPR (Rp 0.1) MPa	0.2% CPR (Rp 0.2) MPa
CPR - 1	140 - 170	150 - 185
CPR - 2	170 - 220	185 - 240
CPR - 3	220 - 260	240 - 280

Range of CPR (Rp 0.2) values 90 – 240 MPa.

CPR (Rp 0.2) ABOVE 190 MPa are with special copper alloy

Nominal CPR value is to be mentioned.

E. ENAMEL

TYPE OF ENAMEL	THERMAL CLASS
Polyvinyl Acetal Base PVA	120° C
Polyesterimide PEI	180° C
Poly amide-imide PAI	200° C
PEI + PAI	200° C
Epoxy based enamel	Used as bond coat . Semicured state

NOTE: PROPERTIES OF ENAMEL ARE AS PER IEC 60317 – RESPECTIVE PART

F. INCREASE DUE TO ENAMEL (Both side increase)

1. EN 1 0.10 +/- 0.02 mm
 2. EN 1 0.08 +/- 0.02 mm
 3. EN 2 0.14 +/- 0.02 mm
 4. EP 2 0.06 +/- 0.02 mm
 5. EP 1 0.04 +/- 0.01 mm
- * EN FOR PVA AND EP FOR EPOXY

G. PAPER, AS PER IEC 554-3

1. Interleaving paper 0.10 mm thickness Standard Kraft paper
0.10 mm Presspan paper
2. Standard Kraft Paper 5A2 1M3
5B2 2M3
5B2 2H1
3. Thermally Upgraded Green 5B4 2M3
4. Thermally Upgraded Crepe paper 22 HCC DENNISON , 42HCF CINDUS
5. Nomex Grade 410 Thickness 0.05 mm
6. Thickness of paper 0.05, 0.063, 0.075, 0.10 mm
7. Net High tensile chemical and oil resistant
Polyester based net of thickness 0.30 mm.
8. Maximum number of paper 32
9. Arrangement of layers
Top Layer - 2 Paper Intercolated with 50% overlapped to each other OR
1 Layer with 50% Overlapped
Inner Layer - Butt lapped or as desired with a staggering of 30 to 40%

H. DIMENSION CALCULATION

1. Max. Axial width (B): $Fw \times 2 (b + EL + EP) + L + I \text{ max.}$
2. Max. Radial height (H):
For Odd Numbered strips $Fh \times (n+1) / 2 (h+ EL + EP) + I \text{ max.}$
For Even Numbered strips $Fh \times (n+2) / 2 (h+ EL + EP) + I \text{ max.}$
3. Min. Axial width $2 (b - bt + EL + EP) + L + I \text{ min.}$
4. Min. Radial height
For Odd Numbered strip $(n + 1) / 2 (h - ht + EL + EP) + I \text{ min.}$
For Even Numbered strip $(n+2) / 2 (h+EL+EP) + I \text{ max.}$

$F_w = 1.01$ For annealed Conductor
 1.02 For CPR Conductor

F_h values are as per Table – 1

TABLE – 1

No. of Strip	For CPR Strip	For Annealed Strip
5 – 17	1.05	1.02
19 - 31	1.04	1.015
33 - 47	1.03	1.01
49 – 63	1.02	1.01

5. PITCH $S = (3.14 \times D) / n$ OR $S = fd \times b$
 6. TRANSPOSING FACTOR $fd = S / b$

PITCH IS DECIDED ON THE BASIS OF HEIGHT TO WIDTH RATIO OF CTC STACK OR THE INNER WINDING DIAMETER OF COIL.

I. NOTATION USED

1. n = Number of strips
2. b = Nominal width of single strip
3. h = Nominal thickness of single strip
4. B = Nominal axial width of covered CTC
5. H = Nominal radial height of covered CTC
6. E = Total increase due to Enamel and Epoxy
7. EL = Increase due to Enamel
8. EP = Increase due to Epoxy
9. I = Increase due to Paper Insulation
10. L = Thickness of Interleaving Paper
11. $bt.$ = Tolerance on Nominal width of bare conductor
12. $ht.$ = Tolerance on Nominal thickness of bare conductor
13. D = Inner diameter of coil
14. fd = Transposing factor
15. d = Height of the cooling duct

J. VENTILATED CTC (CTC WITH COOLING DUCT)

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|-------------------------------|----------------------------------|
| 1. Number of Strip | 31 to 63 |
| 2. Width of Strip | 6.5 to 12.5 mm |
| 3. Thickness of Strip | 1.8 to 2.5 mm |
| 4. Height of the Slot or Duct | 3 to 4 mm |
| 5. Increase due to enamel | 0.14 + - 0.02 mm |
| 6. Pitch of the Duct | 80 to 120 mm |
| 7. Thickness of net | 0.3 mm + / - 0.01 |
| 8. Type of lapping | Single layer with 25% overlapped |

K. DIMENSION CALCULATION

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|-----------------------|--|
| 1. Nom. Axial width | $B = Fw \times 2(b+EL) + L + d + \text{Increase due to net}$ |
| 2. Nom. Radial height | $H = Fh \times (n+1) / 2 (h+EL) + d + \text{Increase due to net}$ |